

Improving Reactive Hazard Management

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U.S. Chemical Safety and Hazard Investigation Board



Joint EFCOG/DOE

Chemical Management 2002 Workshop

November 5-7, 2002



April 21, 1995

Napp Technologies, Lodi, NJ



INADVERTENT MIXING

- Five onsite fatalities
- Some 300 evacuated
- Significant damage to facility and surrounding businesses

Ed Hill, The Record
Rich Gigli, The Record



April 8, 1998

Morton International, Paterson, NJ

RUNAWAY REACTION

- Internal hazard communication
- Reactive hazard management
- Process safety management





Hazard investigation objectives

- Evaluate impacts
- Examine how OSHA and EPA address reactive hazards
- Analyze National Fire Protection Association (NFPA) reactivity ratings
- Examine nonregulatory standards and guidance
- Examine company policies, practices, testing, etc.
- Develop recommendations



Definition: “Reactive Chemical Incident”

A sudden event
involving an uncontrolled chemical reaction -
with significant increases in temperature,
pressure, or gas evolution -
that has the potential to, or has caused,
serious harm to people, property, or the
environment.



Conclusion # 1

Reactive incidents are a significant chemical safety problem

- 167 incidents since 1980
- 108 fatalities
- 5 fatalities per year (average)
- 50 incidents with *public* impact



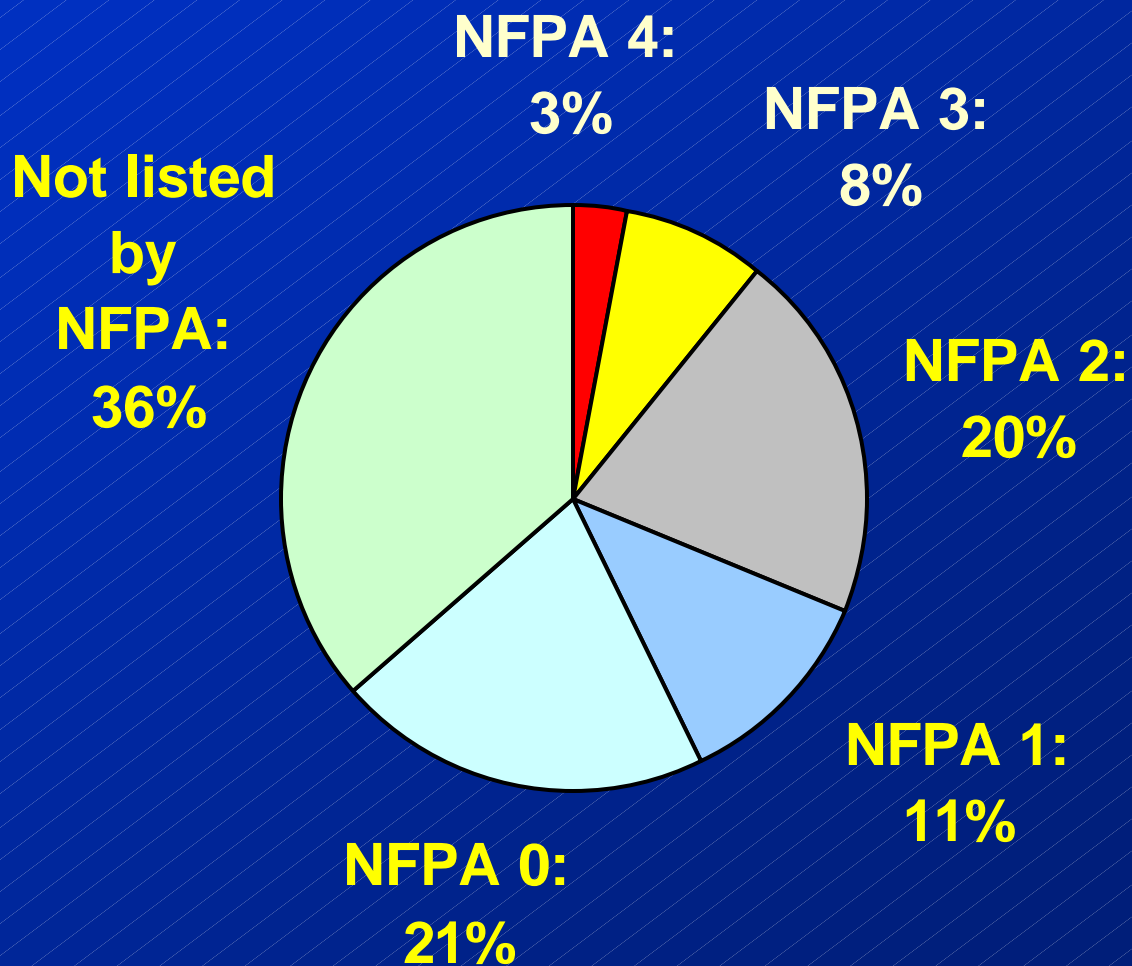
Conclusion # 2

There are significant gaps in safety regulations designed to protect workers from reactive hazards

- Over 50 percent of incidents involved chemicals that are not covered by OSHA process safety regulations**



NFPA instability ratings





Conclusion # 3

NFPA instability ratings are insufficient as the sole basis for determining coverage of reactive hazards in the OSHA PSM standard



Conclusion # 4

Safety regulations designed to protect the public have significant gaps in the coverage of reactive hazards

- **Over 60 percent of incidents involved chemicals not covered by the EPA process safety regulations**



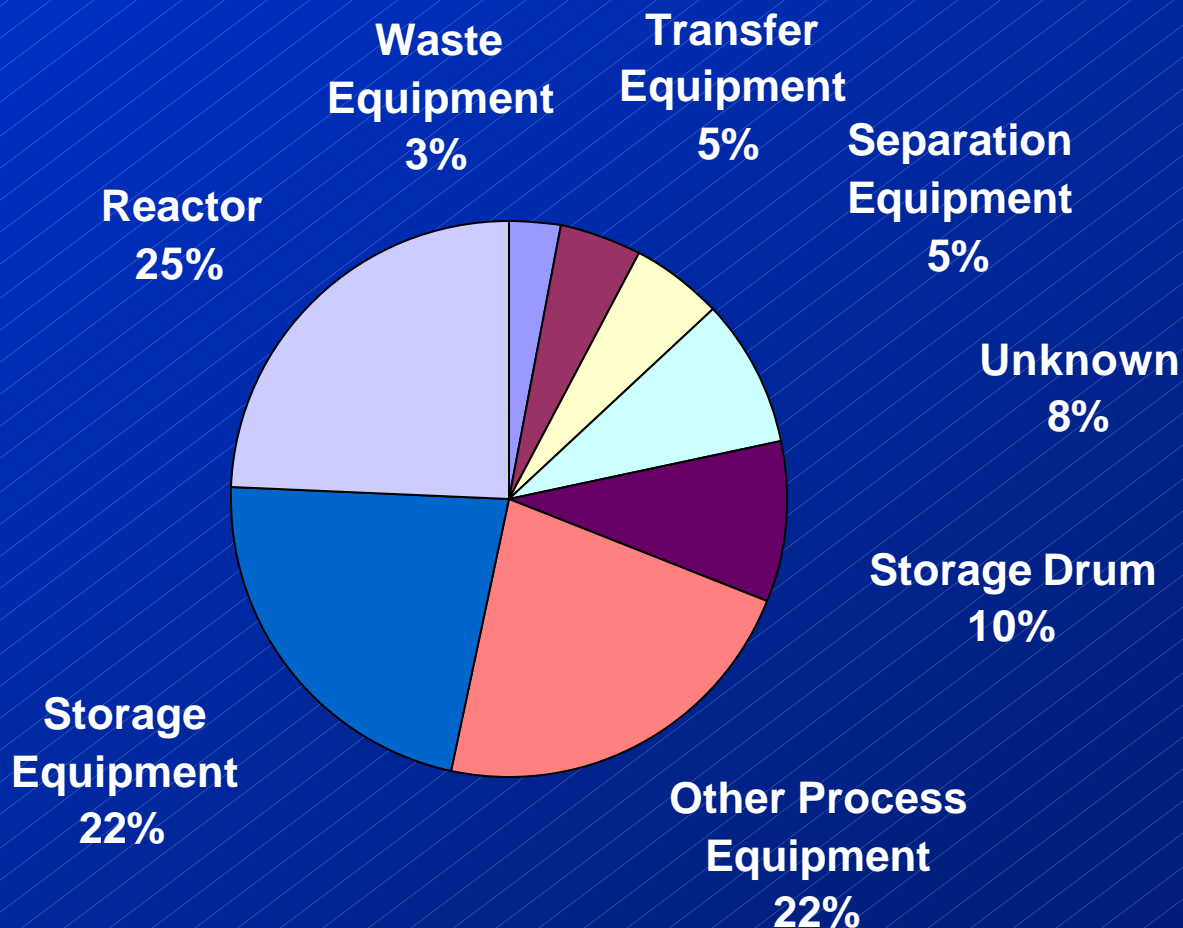
Conclusion # 5

The reactive problem is not adequately defined by simply placing chemicals on a list because:

- **All chemicals can be reactive**
- **Hazards arise from interactions in specific conditions of a chemical process**
- **Reactivity can result in an energy release or a toxic release**



Reactive incidents occur throughout the process





Conclusion # 6

Reactive incidents are not unique to the chemical manufacturing industry

<u>Type of Facility</u>	<u>Percent of Incidents</u>
Chemical manufacturing	70
Storage, handling, consumer sites	Nearly 30



The reactive problem is diverse

Regulators and industry must address the hazards of chemicals and their combinations under specific process conditions

It's not reactive chemicals, it's reactive chemistry – and the management of its hazards.



Conclusion # 7

Existing sources of incident data are not adequate to identify the number, severity, and causes of reactive incidents or to analyze incident frequency trends

- No comprehensive source of chemical incident data**
- OSHA and EPA data sources are not designed to identify and track reactive incidents**



Conclusion # 8

There is no publicly available database for sharing lessons learned from reactive incidents

- **Fewer than 40 of the 167 incidents contained causal or lessons learned information**



Unrecognized hazards lead to incidents

Reactive incidents often caused by inadequate recognition and evaluation of reactive hazards

- **This was the case in 60 percent of incidents with some causal information**



Conclusion # 9

Neither OSHA PSM nor EPA RMP standards explicitly require specific hazards, such as reactive hazards, to be examined when performing a process hazard analysis (PHA)

- Thermal and mechanical shock
- Inadvertent mixing
- Runaway reactions



Conclusion # 10

OSHA PSM and EPA RMP standards do not explicitly require that multiple sources be consulted when compiling necessary process safety information

- **90 % of incidents in data involved known chemistry**
- **25 % of incidents where causal information was known occurred due to inadequate hazard identification**



Conclusion #11

Publicly available resources are not always used by industry to assist in identifying reactive hazards

Literature

- **Brethericks' Handbook of Reactive Chemical Hazards**
- **Sax's Dangerous Properties of Industrial Materials**

Computerized Tools

- **NOAA – The Chemical Reactivity Worksheet**



Conclusion # 12

There is no publicly available database to share reactive chemical test data

- **Companies visited and surveyed very rarely share reactive chemical test data with others in industry**



Conclusion # 13

Industry's voluntary good-practice guidelines for managing reactive hazards are limited and not complete.

- **American Institute of Chemical Engineers' Center for Chemical Process Safety (CCPS)**
- **American Chemistry Council (ACC)**
- **The Synthetic Organic Chemical Manufacturer's Association (SOCMA)**
- **National Association of Chemical Distributors (NACD)**



Conclusion # 14

Given the impact and diversity of reactive hazards, progress in the prevention of reactive incidents requires both enhanced regulatory and nonregulatory programs.



Occupational Safety and Health Administration (OSHA)

Recommendation # 1

Amend the Process Safety Management Standard, 29 CFR 1910.119, to achieve more comprehensive control of reactive hazards that could have catastrophic consequences.



Occupational Safety and Health Administration (OSHA)

Recommendation # 1

Broaden the application to cover reactive hazards resulting from process-specific conditions and combinations of chemicals.

Additionally, broaden coverage of hazards from self-reactive chemicals.



Occupational Safety and Health Administration (OSHA)

Recommendation # 1

In the compilation of process safety information, require that multiple sources of information be sufficiently consulted to understand and control potential reactive hazards.



Occupational Safety and Health Administration (OSHA)

Recommendation # 1

Augment the process hazard analysis element to explicitly require an evaluation of reactive hazards.



Occupational Safety and Health Administration (OSHA)

Recommendation # 2

Implement a program to define and record information on reactive incidents that OSHA investigates or requires to be investigated under OSHA regulations.



U.S. Environmental Protection Agency (EPA)

Recommendation # 1

Revise the Chemical Accident Prevention Programs, 40 CFR 68 (RMP), to include catastrophic reactive hazards, including those resulting from process-specific conditions and combinations of chemicals.



U.S. Environmental Protection Agency (EPA)

Recommendation # 2

Implement a program to define and record reactive incidents.



National Institute of Standards and Technology (NIST)

Develop and implement a publicly available database for reactive hazard test information.



Center for Chemical Process Safety (CCPS)

Publish comprehensive guidance on model reactive hazard management systems.



American Chemistry Council (ACC)

Recommendation # 1

Expand the Responsible Care Process Safety Code to emphasize the need for managing reactive hazards.



American Chemistry Council (ACC)

Recommendation # 2

Develop and implement a program for reporting reactive incidents that includes the sharing of relevant safety knowledge and lessons learned with your membership, the public, and government to improve safety system performance and prevent future incidents.



American Chemistry Council (ACC)

Recommendation # 3

Work with NIST in developing and implementing a publicly available database for reactive hazard test information.



Synthetic Organic Chemical Manufacturers Association (SOCMA)

Recommendation # 1

**Expand the Responsible Care
Process Safety Code to
emphasize the need for
managing reactive hazards.**



Synthetic Organic Chemical Manufacturers Association (SOCMA)

Recommendation # 2

Develop and implement a program for reporting reactive incidents that includes the sharing of relevant safety knowledge and lessons learned with your membership, the public, and government to improve safety system performance and prevent future incidents.



Synthetic Organic Chemical Manufacturers Association (SOCMA)

Recommendation # 3

Work with NIST in developing and implementing a publicly available database for reactive hazard test information.



National Association of Chemical Distributors (NACD)

Expand the existing Responsible Distribution Process to include reactive hazard management as an area of emphasis.



CSB on the WWW

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